Preferences for fat and basic tastes in 3-, 6- and 12-month-old infants

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Preference for fat and basic tastes in 3-, 6-, 12- and 20-month-old infants: a longitudinal approach

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Background

➢ Fat perception received recent interest, but fat preference in humans and in particular in infants is a matter of debate. In the newborn, the sweet taste is liked and calms crying newborns and the bitter taste is rejected, but the taste of oil does not elicit any particular reaction (Graillon & al., 1997). In infants, milk intake is equivalent when fat content varies (Chan & al., 1979; Woolridge & al., 1980), but sucking patterns are longer for fattier milks (Nysenbaum & Smart, 1982).

Objectives

➢ To study acceptance of a fat solution and of basic taste solutions (sweet, salty, bitter, sour and umami) comparatively to water, in order to expand previous findings (Schwartz, Issanchou & Nicklaus, British Journal of Nutrition, 2009)

➢ To study the evolution of fat and taste acceptance longitudinally in the same infants at the ages of 3, 6, 12 and 20 months.

Method

➢ **Participants:**

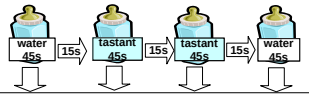
• As part of OPALINE, a longitudinal program studying the development of food preferences in early childhood, 292 healthy infants (137 girls; 155 boys) participated in the present study focusing of taste preferences (at 3 mo, N=193; at 6 mo, N=245; at 12 mo, N=266; at 20 mo, N=253).

Tab.1 : Stimuli: Molecule and concentration

Stimuli	Molecule	Concentration M	Concentration g.L^{-1}
Sweet	Lactose	0.20	71.9
Salty	Sodium Chloride	0.085	5.0
Bitter	Urea	0.18	10.8
Sour	Citric acid	0.006	1.2
Umami	Monosodium glutamate	0.009	1.7
Fat	Sunflower & rapeseed oils	-	0.35

➢ **Procedure:**

• The method was adapted from previous studies (Kajiura & al., 1992; Stein & al., 2005) and was approved by the local ethical committee; informed consent was obtained from both parents.
• For each stimulus, molecule and concentration are presented in Table 1.
• A parent (generally the mother) and his/her infant participated in 2 videotaped sessions.
• For each stimulus, 4 bottles (water, taste solution, taste solution and water) were presented by the experimenter (Fig.1) who was blind to the stimulus.
• At the age of 20 mo the infant could manipulate the bottle him/herself.
• The 5 tastes were presented in a balanced order; the fat stimulus was assessed after.
• Each bottle contained 30 ml at 3 & 6 mo and 50 ml at 12 & 20 mo, except for urea (15ml). Bottles were weighed before/after ingestion.
• A judgment of the infant's liking of the content of each bottle was scored on a 5 pt-scale by the parent and by the experimenter.



Variables	Bottle 1	Bottle 2	Bottle 3	Bottle 4	Ratios
Intake (volume, g)	Volume 1	Volume 2	Volume 3	Volume 4	
Parent's judgment of liking (5-pt scale)	P. liking 1	P. liking 2	P. liking 3	P. liking 4	(2+3)/(1+2+3+4)
Experimenter's judgment of liking (5-pt scale)	E. liking 1	E. liking 2	E. liking 3	E. liking 4	

Fig.1 : Procedure & variables

➢ **Analysis:**

• Analysis was restricted to infants who complied and consumed at least 1.0 g from 2 bottles.
• For each measured variable, ratios were calculated as shown in Fig.1, to represent acceptance of the stimuli solution relatively to water. By definition each ratio may vary between 0 and 1; a ratio of 0.5 indicates indifference to the stimuli solution relatively to water. A ratio > 0.5 indicates preference for the stimuli relatively to water. A ratio < 0.5 indicates rejection of the stimuli relatively to water.
• Data were analyzed with a mixed model, using the R statistical package, for each ratio separately. For each ratio, the model hypothesized (i) a stimulus effect, (ii) a factorial or a quadratic effect of age for each stimulus, (iii) that at the child level, intercept and slope were randomly distributed for each stimulus, with the same variance across stimuli for the individual intercepts and no correlation between stimuli.

Results

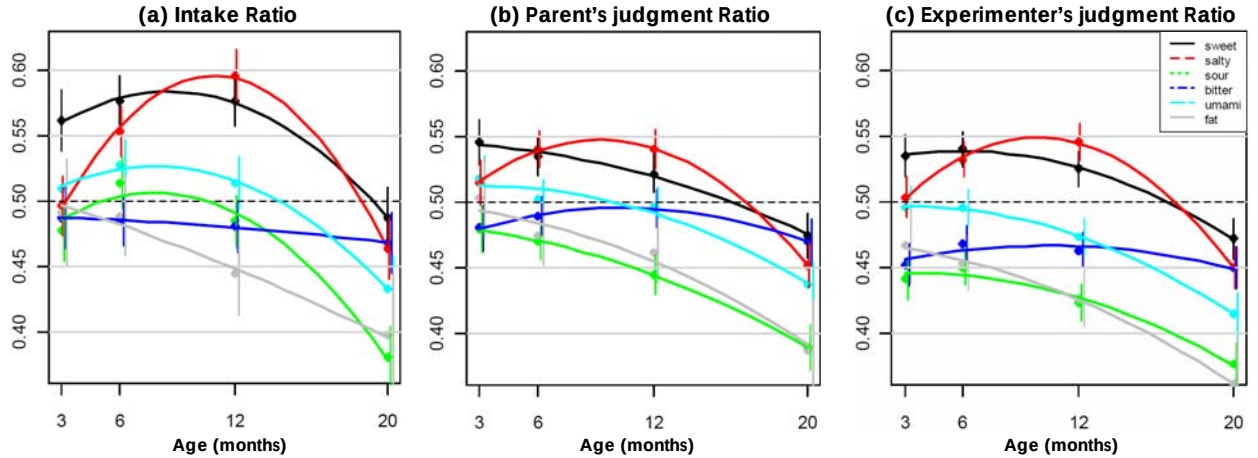


Fig. 1: Modeling the evolution of acceptance (ratios of intake (a), of parent's (b) and of experimenter's judgment of liking (c)) of basic taste solutions and of a fat solution at the ages of 3, 6, 12 and 20 months. Dots represent predicted values from models with age as a factor; lines represent predicted values from models with a quadratic effect of age; vertical lines represent 95% CI.

➢ **Intake**

• For the salty taste, acceptance evolved sharply: it increased between 3 and 12 mo (at 12 mo no difference with acceptance of sweet taste), then decreased.
• For sweet, sour and umami tastes, the evolution was the same, with a decrease in acceptance at 20 mo. The sweet taste was the only taste not rejected at 20 mo.
• For the bitter taste, acceptance was stable between 3 and 20 mo.
• For the fat stimulus, there was a clear decrease in acceptance with age, from indifference at 3 mo to rejection at 20 mo.
• Larger differences between stimuli were observed at 12 mo compared to other ages.

➢ **Parent's or of experimenter's judgement of liking**

• Conclusions are similar when considering ratios of parent's or of experimenter's judgement of liking and ratios of intake. However, the intake ratio reveals a better discrimination between stimuli.
• The experimenter's judgment ratio reveals lower acceptance for the sour, bitter and umami tastes and for the fat solution compared to the parent's judgment ratio: the experimenter may have observed more sharply negative facial expressions and other behaviors revealing rejections of the bitter, sour, umami and fat solutions.
• The preference for sweet and salty solutions is highlighted clearly by intake ratio but not so much by parent's and experimenter's judgment of liking, suggesting that few expressions or behaviors reflecting positive affects were observable.

Discussion & Conclusion

• Development of a preference for the salty taste between 3 and 6 mo is in line with previous findings (Beauchamp & al., 1986).
• The fact that evolutions were not uniform across tastes over the first year (i.e. changes in acceptance did not occur for bitter; and occurred differently for salty taste on one side and for sweet, sour and umami tastes on the other side) suggests that these evolutions are not due to a general change in taste perception.
• The lower acceptances at 20 mo observed for all stimuli could be due to a context effect: infants have learned to encounter fat and sweet, sour, salty and umami tastes in foods and not in water and thus could perceive water solutions of these stimuli as unfamiliar. Infants might be less exposed to the bitter taste in foods, explaining the stability of acceptance of this taste in water solution. Thus measuring acceptance of tastes in water solutions in order to predict food preferences could be relevant at 12 mo but no more at 20 mo.
• The present findings raise questions about an 'innate' preference for fat. Here, the olfactory component of fat might be involved in this rejection (due to partial oxydation) and might be perceived more when infants grow older. The preference for fat may be related to learning effect due to the energy it brings.

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